Logistics Management Institute

Future Vision for the Air Force Logistics System

IR503MR1

Doug Blazer

LMI

July 1996

Future Vision for the Air Force Logistics System

IR503MR1

Doug Blazer

Prepared pursuant to Department of Defense Contract DASW01-95-C-0019. The views expressed here are those of the Logistics Management Institute at the time of issue but not necessarily those of the Department of Defense.

Logistics Management Institute
2000 Corporate Ridge
McLean, Virginia 22102-7805

Future Vision for the Air Force Logistics System

Executive Summary

The U.S. Air Force maintains an inventory of over $30 billion in aircraft reparable spare parts and spends between $2 billion and $3 billion a year to buy and repair them. To determine these buy and repair requirements, guide the distribution of these expensive assets among Air Force bases and depots around the world, and track demand history and item characteristics, the Air Force has built and operates a complex interconnected set of automated systems. In the 1990s, the Air Force recoverable spares logistics systems are undergoing unprecedented review and change. These changes include stock funding of depot-level reparables, inventory reduction programs, lean logistics, reengineering, and the changes flowing from the Air Force Materiel Command's Senior Level Management Course. Are the current and planned changes to the way the Air Force computes requirements, allocates levels and resources, and distributes assets consistent and compatible with each other and with senior leadership's vision?

We identify the weaknesses of the current logistics systems and propose a logistics systems architecture that is consistent with the Air Force leadership's vision. In the proposed logistics system architecture, we focus on achieving the Air Force's aircraft availability goals at minimum cost. The proposed architecture uses aircraft availability driven models to compute buy and repair requirements, allocate resources and levels, distribute assets, and measure system performance centrally. The data support continuing the current Air Force efforts to reduce pipeline times, and we recommend that the Air Force take steps to improve its database accuracy and responsiveness.

In order to implement the Air Force senior leadership's logistics vision, management must focus attention on 26 areas. Primarily, the Air Force must improve its data accuracy and database responsiveness and provide more consistency among the individual logistics systems. Management effort is needed to improve near-term forecasting and requirements data for budgeting repair requirements and allocating central levels, ensure the accuracy and validity of the Air Force requisitioning process, improve the process to redistribute incorrectly distributed assets, and improve the measurement and management use of pipeline performance data. We also propose that the Air Force establish a requirements team to maintain and operate the Air Force requirements, allocation, and distribution models and ensure the accuracy of the requirements database.

Contents

Chapter 1. Introduction 1-1

The Problem 1-1
Background — A Historical Perspective 1-2
Report Organization 1-5

Chapter 2. The Current System 2-1

Introduction 2-1
Overview of the Current System 2-1
Current System Weaknesses 2-3
Recent Improvement Efforts 2-6
Lean Logistics 2-6
Requirements Reengineering 2-7
EXPRESS 2-9

Chapter 3. New Air Force Logistics System 3-1

Inventory Principles 3-1
Goal of a Requirements System 3-2
Current Proposals for Improving the Air Force Requirements System 3-3
Proposals to Improve the Air Force Requirements System 3-5

Chapter 4. Future Air Force Requirements, Allocation, and Distribution Systems 4-1

Systems Architecture 4-1
Streamline the Process 4-1
Future Air Force Requirements System 4-1
Data Needs 4-8

Contents (Continued)

Chapter 5. Areas Requiring Management Attention and Analysis 5-1

Introduction 5-1

Summary of Proposed Areas Requiring Management Attention 5-3

References ..... Ref. 1

Glossary ..... Gloss. 1

Illustrations

2-1. D041 Interfacing Systems 2-4

4-1. Primary Operating Stock Requirements and Leveling 4-2

4-2. Reparable Logistics Pipeline 4-3

Tables

1-1. Spares Requirements, Allocation, and Distribution Matrix —
A Historical Perspective 1-3

1-2. Spares Requirements, Allocation, and Distribution Matrix —
Simplified View 1-4

1-3. Analysis Needs Identified in the 1990 Air Staff Report 1-5

2-1. Spares Requirements, Allocation, and Distribution Matrix —
"Old" Current System 2-2

2-2. Summary of Weaknesses of the Current System 2-6

3-1. A Comparison of Data Needs for Three Requirements Models 3-4

4-1. Proposed Requirements System Architecture 4-2

5-1. Proposed Areas Requiring Management Attention 5-2

CHAPTER 1

Introduction

THE PROBLEM

In all quarters of the logistics community, plans and discussions are focused on changing the future Air Force recoverable spares logistics systems — those sets of procedures, databases, and computer software that control the computation and execution of buy and repair requirements and the allocation and distribution of recoverable spares. Are these current and planned changes to the Air Force spares requirements, allocation, and distribution systems consistent and compatible with each other and with senior leadership's vision? In the last five years, the Air Force has implemented several changes to the spares requirements, allocation, and distribution systems and plans many more changes. Most of the proposed changes to the current systems have been developed and demonstrated independently, and, although each change may improve a segment of the overall spares system, no one has examined the overall system and the way the pieces fit together.

In addition, the current trend toward actual implementations (in the form of tests and demonstrations) emphasizes proving concepts and determining the impact of changes to the systems in lieu of theoretical analysis. A general dissatisfaction with the current system has led to at least six major reengineering efforts (requirements, financial management, workload, production, initial provisioning, stock control and distribution, and supply support) that are charged with improving the spares systems. In addition to these reengineering efforts, the Air Force is implementing a concept called lean logistics (LL), and the combination of the two efforts fundamentally changes the way the depot operates. The Air Force logistics systems are undergoing the biggest set of changes in its history, and these changes raise a number of questions: Will the systems be able to keep pace? Will all of these individual, somewhat independent efforts produce a compatible and consistent system? How should the Air Force's analysis community identify the most promising of the initiatives and set priorities for and help with implementation efforts?

This report will meet the following four objectives:

- Describe the current direction of the Air Force logistics recoverable spares requirements, allocation, and distribution systems.
- Define what logistics recoverable spares systems must do.

- Identify areas of the Air Force spares requirements, allocation, and distribution systems that need management attention.

- Propose a vision, a systems architecture, for the Air Force systems.

BACKGROUND — A HISTORICAL PERSPECTIVE

A 1990 Air Staff report, *Air Force Requirements, Allocation and Distribution System Consistency*, provides a baseline for a historical perspective of Air Force plans for the spares system. [1] Table 1-1, an extract from that report, shows all the functions of the system current at that time and the changes planned for that system. Table 1-1 reflects the culmination of years of changes to the Air Force requirements system aimed primarily at (1) taking a multi-echelon systems perspective of the Air Force spares inventory system; and (2) computing requirements, allocating resources, and distributing spares to achieve operationally driven targets.

For example, the Logistics Management Institute's Aircraft Availability Model (AAM) replaced the variable safety level (VSL) for aircraft items, the Requirements Execution Availability Logistics Module (REALM) [with the Aircraft Sustainability Model (ASM)] replaced the War Reserves Requirements System (D029), and the Central Leveling System (D028) replaced the Standard Base Supply System (SBSS) Repair Cycle Demand Level. The Air Force Materiel Command (AFMC) [then Air Force Logistics Command (AFLC)] was developing Distribution and Repair in a Variable Environment (DRIVE) to replace the Management of Items Subject to Repair (MISTR) process (repair requirements) and Uniform Materiel Movement and Issue Priority System (UMMIPS) (distribution). These changes reflect years of planning and systems development.

Since the early 1980s, the overriding goal for improving the Air Force spares systems has been to relate all inventory resource decisions to operational target — i.e., aircraft availability. The Air Force has always wanted to relate inventory decisions to operational capability, but it became a necessity in the 1980s when resources became scarce because of partial funding for peacetime buy and repair and virtually no funding for buying wartime spares. Computing and defending budgets and allocating scarce dollars based on aircraft availability became paramount.

Table 1-1.
Spares Requirements, Allocation, and Distribution Matrix — A Historical Perspective

Model/system	Function: POS buy require-ment	Repair require-ment	Wartime buy require-ment	Peacetime allocation and distribution	Wartime allocation and distribution
Current					
AAM/VSL	X	X			
Central Leveling System				X	
DRIVE		X		X	X
CIP	X	X	X	X	X
SC&D				X	
Requisition schedule					X
ASM					
OWRM computation			X		
New initiatives					
Stock funding depot-level reparables	X	X			
Alternative levels of maintenance		X		X	X
Theater DRIVE		X		X	X
Ops/Log priority matrix			X		X
New WRSK/BLSS computation			X		X
Follow-on spares kit computation			X		X

Note: POS = peacetime operating stock; CIP = Critical Item Program; SC&D = Stock Control and Distribution; Ops/Log = Operations Logistics; OWRM = Other War Reserve Materiel; WRSK = War Readiness Spares Kit; and BLSS = Base Level Self-Sufficiency Spares.

The 1990 Air Staff report provided an architecture for the Air Force spares systems of the future and identified needed analysis efforts. Table 1-2 provides a simplified view of the systems architecture proposed in the Air Staff report.

The spares systems include five functions — peacetime operating stock (POS) buy requirements determination, repair requirements determination, wartime spares buy requirements determination, POS allocation and distribution, and wartime spares allocation and distribution. Basically, the report proposed using

- the AAM for determining the POS buy requirement,
- the AAM for budgeting and DRIVE for executing the repair requirement,
- the ASM for computing wartime spares requirements,

- the D028 for allocating levels and DRIVE for distributing spares, and

- DRIVE and the operations and logistics (Ops/Log) priority matrix for distributing wartime spares.

Table 1-2.
Spares Requirements, Allocation, and Distribution Matrix — Simplified View

Model/system	Function				
	POS buy requirement	Repair requirement	Wartime buy requirement	Peacetime allocation and distribution	Wartime allocation and distribution
AAM	X	X			
Central Leveling System (D028)				X	
DRIVE		X		X	X
REALM			X		
Ops/Log priority matrix			X		X
ASM			X		

The 1990 Air Staff report proposed a system architecture that included stock funding depot-level reparables (SFDLRs) and alternative levels of maintenance (now more familiarly known as two-levels of maintenance). Therefore, these initiatives were considered part of future systems. However, the Air Staff published this report well before lean logistics and reengineering were shaping Air Force logistics. In the next chapters, we describe the current system in light of these two major efforts.

The Air Staff report identified 18 areas that need management attention and further analysis (Table 1-3) to ensure that future spares systems are successfully implemented and consistent and compatible with each other and the goals of the Air Force. The analysis needs can be divided into two major areas. First, DRIVE must be consistent with all the other peacetime and wartime buy, repair, and allocation systems (analysis needs 3, 4, 10, 11, 13, 14, 15 and 18). Second, the Air Force must set operational targets and allocate resources consistent with maximizing operational capability (analysis needs 1, 2, 5, 6, 7, 8, 9, 12, 16 and 17).

Table 1-3.
Analysis Needs Identified in the 1990 Air Staff Report

1.	Stock funding buy initiatives
2.	Setting aircraft availability targets in the AAM
3.	Concept of operations for AAM and DRIVE
4.	DRIVE priorities for critical items
5.	SFDLR at MAJCOM regional repair centers
6.	Setting aircraft availability targets in DRIVE
7.	Setting repair and buy funding levels
8.	60-day WRSK/BLSS computation
9.	OWRM computation
10.	Comparative analysis of DRIVE and D028
11.	DRIVE distribution policy
12.	SFDLR credit policy
13.	Redistribution policy
14.	Theater DRIVE in regional repair centers
15.	DRIVE database review
16.	Requisition schedule alternatives
17.	Days 31 – 60 spares distribution
18.	DRIVE availability targets

Note: MAJCOM = major command.

REPORT ORGANIZATION

This report comprises five chapters. Chapter 2 includes a discussion of the existing systems and the proposed changes and describes the current trends in Air Force systems development. Chapter 3 includes the requirements for the future systems and a description of the functional need, i.e., what requirements, allocation, and distribution systems must do. In Chapter 4, we describe a system architecture for the future Air Force logistics recoverable spares systems. Finally, in Chapter 5, we identify areas that management must emphasize in order to develop a "seamless" logistics system that fulfills senior leadership's expectations.

CHAPTER 2

The Current System

INTRODUCTION

Discussing the current system is difficult because there is no single current system. The "old" Recoverable Consumption Item Requirements System (D041) that consists of the AAM; the MISTR process to guide depot repair; an extensive, antiquated database; and numerous other subsystems is still the system most often used for requirements at AFMC. However, DRIVE is used to set repair priorities and distribute assets for some F-16 aircraft items at Ogden Air Logistics Center (ALC) and sporadically at other centers. In addition, numerous LL demonstrations are prototyping other methods to determine and execute repair requirements. Also, through various reengineering initiatives, LL, and the Execution and Prioritization of Repair Support System (EXPRESS), the Air Force is trying to change parts of the requirements system. These other efforts are in various stages of implementation. In this chapter, we will document the existing system and its weaknesses and the efforts to address these weaknesses.

OVERVIEW OF THE CURRENT SYSTEM

The Air Force most often uses the requirements, allocation, and distribution systems listed in Table 2-1. Table 2-1 also lists functions for each system.

Table 2-1 differs from Table 1-2. The AAM (and VSL for nonaircraft items) and its supporting D041 database are still used to compute the POS buy requirement and partially used for repair requirements. As documented in the 1990 Air Staff report, AFMC intended to use DRIVE to set priorities and determine repair inductions. Ogden ALC is using DRIVE to set priorities for F-16 spares repair and distribute spares and is being run (but not extensively used) at other ALCs. Even more recently, the Air Force has proposed LL concepts to replace MISTR. But for now MISTR continues to be the predominant repair requirements and induction system. Similarly DRIVE is currently being used to distribute spares for a relatively small subset of items. The Air Force is still using UMMIPS logic (first come, first served within a priority group) to distribute assets for most of its items.

Table 2-1.
Spares Requirements, Allocation, and Distribution Matrix — "Old" Current System

Model/system	Function: POS buy requirement	Repair requirement	Wartime buy requirement	Peacetime allocation and distribution	Wartime allocation and distribution
AAM/D041	X	P			
MISTR		P			
DRIVE		P		P	P
Central Leveling System (D028)					
REALM (ASM)			X		
UMMIPS				P	P
Ops/Log priority matrix					

Note: P means partially used (used for some items).

Historically, the Air Force used the D028 to allocate the worldwide requirement of peacetime spares to the bases but decided to discontinue its use shortly after the Persian Gulf War. The D028 did not respond quickly enough to the fast-changing wartime unit movements. During the war, the Air Force completed a portion of the Stock Control and Distribution System (D035), which contained the data that were fed to D028. As a result of the conversion, the program AFMC used to extract data to feed D028 did not work properly and produced inaccurate levels of allocation. The Air Force decided to discontinue central leveling in light of these two problems. However, the Air Force has recently decided to implement a new centralized readiness based leveling (RBL) system that corrects both of these previous problems.

Finally, although the Air Force approved the Ops/Log priority matrix for setting priorities for procuring and allocating wartime spares, it has not been implemented. Buying and allocating wartime spares is still based on weapon systems managers, item managers, and major command (MAJCOM) initiative rather than on any systematic weapon system availability prioritization technique (e.g., marginal analysis). The Air Force no longer uses a requisition schedule to allocate wartime spares. The requisition schedule was an attempt to allocate wartime spares shortages to the units by assigning unsupportable (requirements without assets) requirements to individual units. The Ops/Log priority matrix and DRIVE were supposed to eliminate the need for the requisition schedule.

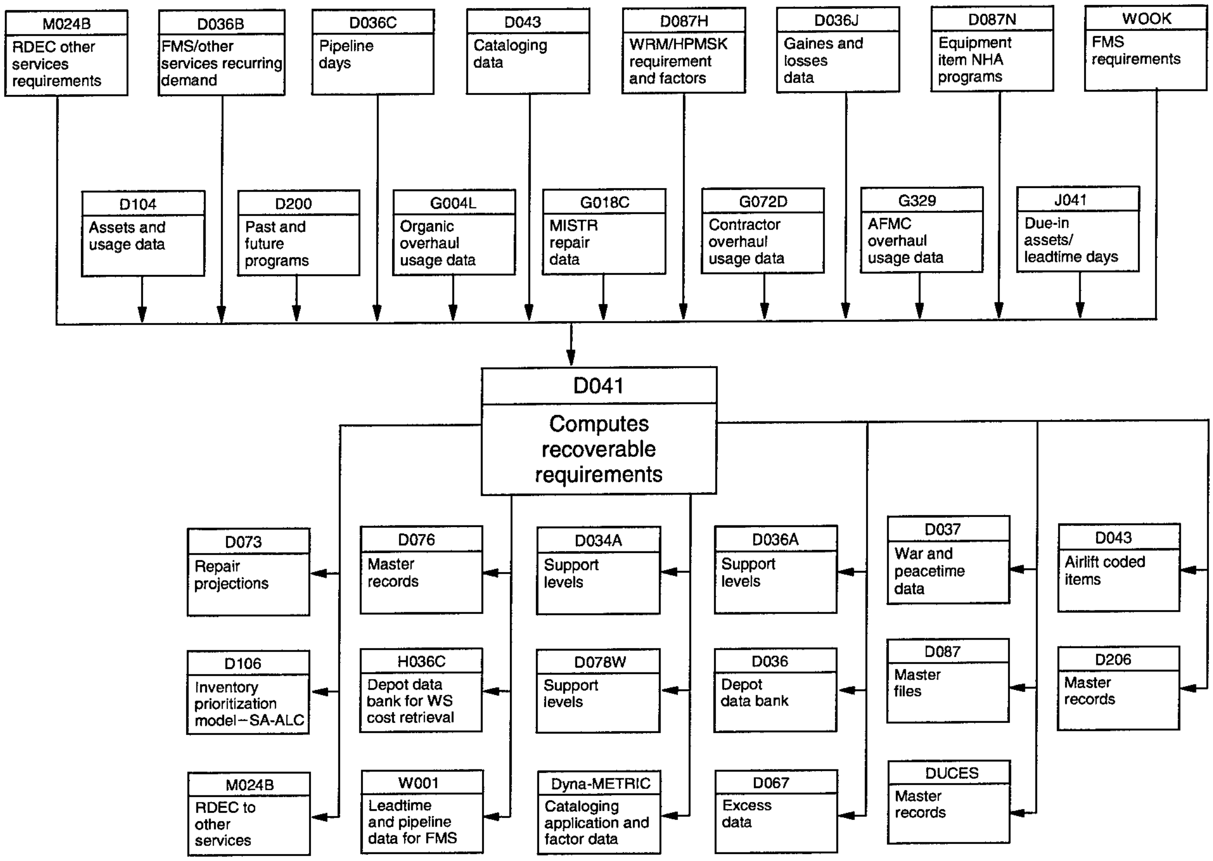
The Air Force has virtually negated the other war reserve materiel (OWRM) requirement. The OWRM computation lacked validity and, as a result, has not been funded recently (or even seriously considered). The OWRM concept remains valid even though the computation is not, but the current Air Force computation of OWRM has been officially ignored for many years.

CURRENT SYSTEM WEAKNESSES

The current system has a number of weaknesses. Perhaps the biggest weakness is the antiquated D041 database and interfaces. More than 30 major systems interface with D041 (see Figure 2-1), and most of these systems, such as D041, are batch oriented. The system requires 90 days to gather, review, update, correct, run, and rerun the D041 requirement. This process requires so much manual work that, although AFMC computes requirements quarterly, the file maintenance necessary to make the data useful is only conducted twice annually. Thus, requirements are computed and available for buy and repair actions in January for a database cut-off date of the previous September. The Air Force is aware of the inadequacies of the D041 database and has expended major efforts to modernize it. However, the last two major efforts — the Requirements Data Bank (RDB) and the Advanced Logistics System (ALS) — ended in failure. Development of these two systems, in effect, froze any efforts to improve the D041 database and its interfaces for nearly 20 years.

Another weakness related to the ineffective database is the gap between computing the requirement and actually executing the requirement. By execution, we mean buying, repairing, and distributing spares. This gap is especially a problem for repair execution computed by MISTR. Several factors contribute to the difference between the computed repair requirement and actual repair needs. The first factor is the database. Again, it takes 90 days to ready the database to compute the requirement. Then, it takes another quarter to negotiate the repair requirement (in part because the inaccurate data have created a lack of trust in the repair requirement). So it takes six months to determine what to repair over the subsequent three months; the Air Force is actually forecasting history. The system forecasts nine months of failures to predict what to repair next, and nine months have passed before the first repair is made. The Air Force must do something to reduce the gap between the requirements computation and the actual execution of the requirement.

Even a very good forecasting system would have difficulty developing accurate national stock number specific, nine month forecasts of worldwide reparable failures, and the D041 forecasting system is not a particularly good one. Several studies suggested improvements to the D041 forecasting system, and implementation of those improvements was scheduled in RDB. [2, 3] The D041 forecasting system is probably adequate for long-range procurement forecasts with a two to four year forecast horizon, but it is not a particularly good forecast tool for near-term repair requirements. D041 uses a two-year moving average to forecast; there are better methods for short range forecasts (forecasts for 7 to 90 days).



Note: RDEC = requirements data exchange cards; FMS = foreign military sales; WRM = war reserve materiel; HPMSK = High Priority Mission Support Kit; NHA = next higher assembly; AFMC = Air Force Materiel Command; SA-ALC = San Antonio Air Logistics Center; and WS = weapon system.

Figure 2-1.
D041 Interfacing Systems

In execution, the current system does not set requirements priorities, and, therefore, the user has no assurances that resources (repair and buy dollars) have been efficiently allocated. The AAM, the computational heart of the D041, does use an item's increase in aircraft availability per procurement dollar to set requirements priorities. The AAM can also use an item's increase in aircraft availability per repair dollar to set requirements priorities, but AFMC did not implement this capability. However, in execution these prioritized lists are not used; what is bought and repaired is more a function of the effectiveness of the item manager than an item's contribution to aircraft availability.

AFMC has developed a process called *banding* for allocating limited depot-level reparable POS buy funding to weapon systems. Weapon systems are divided into groups (bands) according to their importance, and funds are allocated in decreasing percentages by band or weapon system priority grouping. Through trial and error, the total funding is allocated to weapon systems so that

weapon systems in the same band are all the same distance below their availability target and those in higher priority bands are closer to their target than those in lower bands. Banding also includes adjustments to the requirements to reflect reduced pipelines and the ability to cannibalize spares. These adjustments should reflect achievable management adaptations the Air Force can make to achieve the weapon system goals.

The banding process is a step in the right direction; it allocates scarce dollars to weapon systems and to individual stock number requirements. However, it does not provide the tools necessary to set priorities for buys among individual stock numbers if the banding requirement changes for some reason. It does not provide a specific way to assign a higher priority to one asset over another when the manager, who is responsible for buy and repair decisions, cannot follow the banding guidance explicitly because of an unexpected requirement or an error in the data used for the banding. The AAM can and does rank each asset based on its contribution (per dollar) to aircraft availability, but the output is not made available to the execution manager. In addition, AFMC needs explicit execution guidance and a performance measurement tool with which to evaluate adherence to banding allocations. The system needs a feedback mechanism to enforce the smartest buy and repair or to identify problems with the banding process for later correction.

In fact, a final overall weakness is the lack of any feedback loop or systemic performance measurement tool with which to manage the requirements execution system. While AFMC is motivated to improve, they have no tools with which to measure either the improvement itself or the effect of the improvement on the entire system. The current system does not effectively measure pipeline performance or the accuracy of pipeline times. There are efforts to measure and improve portions of the system, but they could have suboptimal consequences. For example, depot labor efficiency measures encourage longer, batch repair runs, which may not be responsive to customer requirements. Reducing transportation cost by using less than premium transportation modes or by holding cargo to increase aircraft utilization is another example. Again, nonresponsive, longer pipelines mean increased inventory investment, which results in orders of magnitude that cost more than was saved through reduced transportation costs. Table 2-2 summarizes the weakness of the current system. [4]

Table 2-2.
Summary of Weaknesses of the Current System

Weaknesses of the current system
Lack of responsive data and management systems
Requirement for manually intensive file maintenance and system intervention
Disconnect between what is being repaired and what is needed
Lack of prioritization and inefficient allocation of resources
Ineffective forecasting tools for near-term execution
Lack of system-wide performance management system

Item managers, in particular, have little confidence in the accuracy of today's requirements. The system is very often inaccurate, updating and correcting the data to make it valid requires considerable man-hours, and the system is neither responsive nor well understood. Few item managers are experts on the 30 plus systems that feed the D041, and many do not understand the algorithms used to compute the requirements. What item managers do understand is requisitions, telephone calls from requisitioners, and depot backorders. Taking an item manager's view of the requirements system leads to approaches to improve the current system.

Recent Improvement Efforts

The weaknesses of the current system are well documented [4], and three efforts are currently underway that propose ways to correct these weaknesses. These current programs to improve the requirements system are LL, requirements reengineering (RR), and EXPRESS.

Lean Logistics

Lean logistics is an Air Force program that takes a systems perspective to implementing improved business practices and streamlining the Air Force logistics systems. The LL working groups are exploring the entire system for process improvements; so far their efforts have been most effective in reducing the pipelines and improving the depot repair execution process.

A number of LL demonstrations use expedited handling and transportation to reduce pipelines and a repair concept, repair on demand, that significantly reduces depot repair processing times to streamline the logistics process. A typical demonstration consists of a conversion of all the items repaired in an LL shop to use expedited handling and premium transportation (shipments to and from the depot), and repair on demand. The LL working groups realize that the cost of

premium transportation is far less than the inventory investment expense caused by increased pipelines. The LL pipeline reduction improvements have been dramatic, especially for depot processing time, which has been reduced from an average of 40 days to 5 days.

Much of the reduction in depot processing time is a result of repairing on demand rather than repairing in batches every quarter as the current MISTR system does. Repairing on demand involves computing a depot repair induction level called a *working level.* Whenever existing stocks in depot repair plus serviceable stock on the shelf at the depot fall below the working level, another reparable is inducted to repair. The LL repair induction system corrects some of the current system weaknesses. It uses recent demand to forecast future demand and is relatively simple to manage and operate. Although it relies on forecasting to set the working level, it is self-correcting; if more demands occur than expected, more carcasses will automatically be inducted into repair, and vice versa. This method contrasts with the current MISTR negotiation process, which inducts the negotiated quantity no matter what the demand experience.

The LL working groups are also developing new prototype computer systems to measure pipeline and repair process performance, compute working levels, and determine when and how much to repair. Further analysis will determine the best ways to compute, update, and monitor repair inductions and the best way to integrate these prototype systems into the long term repair requirements system. But the demonstrations show the promise of the concept. In addition, LL is still early in the implementation phase; only 12 percent (64 out of 541) of the AFMC repair shops have been converted to LL at this time. [5]

Requirements Reengineering

Each of the five ALCs, along with team members from the other centers and major air commands, will analyze a major subportion of Air Force logistics and recommend significant and innovative improvements. The Oklahoma City Air Logistics Center (OC-ALC) will reengineer the requirements process. The repair requirements part of the OC-ALC reengineering effort is basically the repair-on-demand concept. The OC-ALC reengineering team is currently developing and preparing to prototype the peacetime spares procurement requirement process for demonstration.

The OC-ALC requirements reengineering team is proposing that the Air Force implement a system being developed for the Navy called the Requirements Determination Model (RDM). The RDM will work with a recently developed pipeline management system, the Consolidated Serviceable Inventory Visibility Tool (CSIVZ), to "manage data used for requirements determination and analysis." [6] The RDM will identify procurement termination and excess quantities and project annual repair requirements for planning and budgeting purposes.

RDM is a spreadsheet that calculates fiscal year-end posture and budget period requirements. RDM is still in development, but, according to its preliminary documentation, RDM computes a total planning budget objective, "which is the minimum number of assets that must be available to support the mission during the delivery period." [6] The document does not provide any definition of the term *support*.

The total planning budget objective is "working level plus all additives." This approach is consistent with the RR team's item manager perspective of requirements. RDM is a single-echelon model that computes requirements for the depot based on requisitions it receives from the bases. According to its documentation, it does not compute base-level requirements; they must be computed elsewhere and included as an addition to the total planning budget objective. RDM is under development and analysis and will be part of the OC-ALC demonstrations in 1996.

Clearly, whether or not a single-echelon model will improve the Air Force requirements process and Air Force requirements raises some concerns. In fact, it is not clear from the existing documentation that the RDM will even satisfy the Air Force's need for a requirements system. For example, who will compute base-level requirements and how will they accomplish this task? The Air Force needs to further analyze RDM; the OC-ALC demonstration scheduled for next year can only address part of the analysis needs. The OC-ALC demonstration can test the feasibility of RDM but not the validity and accuracy of RDM or whether or not it has the required functionality.

In addition, RDM has a potential inconsistency with the base-leveling system. The Air Force recently approved RBL implementation for setting base and depot working levels. [7] RBL is similar to the old D028; it allocates the D041-computed, worldwide requirement to the bases and the depot (the working level) to minimize base-level backorders. [8] RBL starts with the worldwide organizational-intermediate maintenance requirement, which is generated from base-level failures, and allocates it to the base and depot. RDM, on the other hand, computes the working level to generate the worldwide requirement. RDM, therefore, may not be consistent with RBL. Further analysis is necessary.

AFMC has six separate reengineering efforts underway. All of these efforts affect the requirements system either directly through the OC-ALC RR team or indirectly through the reengineering interfacing system (e.g., stock control and distribution, depot maintenance process, and depot parts support). The way that all these separate efforts will merge into one system is not evident. AFMC recognizes the potential problems involved in pursuing these separate efforts and has charged a headquarters team with coordinating them to ensure consistency with Air Force goals and with each other. This task is difficult. Obviously, the Air Force should develop some overall system perspective and architecture to ensure that they do not expend too many resources developing and demonstrating systems that will not work together.

EXPRESS

The latest of the AFMC efforts to improve the requirements system is Execution and Prioritization of Repair Support System or EXPRESS. [4] Currently under development and scheduled for demonstration in June 1996, EXPRESS is a combination of DRIVE and the LL working-level method of setting priorities and determining which items to repair. EXPRESS uses the Automated Induction System (AIS), the DRIVE model for DRIVE applicable items (aircraft flying hour based items), and the working-level concept for all non-DRIVE items. DRIVE uses marginal analysis to set priorities for repair. EXPRESS will use the *deepest hole* or lowest depot fill rate to set priorities for non-DRIVE items. The Air Force is currently analyzing these systems and trying to determine the most efficient way to merge the two priority lists into one comprehensive list. This analysis is an important effort; whether or not DRIVE will develop the same priority list as EXPRESS is not clear. Setting the appropriate priorities or merging the lists could result in less minimum support (aircraft availability) per repair dollar.

Current development of EXPRESS also includes an automated system to answer the questions "can an item be repaired?" and "if not, why not?" Before induction of an item for repair, EXPRESS will determine whether or not the shop has sufficient carcasses, manpower, capacity, funding, and parts support to complete the required repair. If an item cannot be repaired, the EXPRESS supportability module will notify management of the constraint and recommend action to alleviate the constraint.

RBL is an integral part of EXPRESS. It will be used to compute base and depot working levels.

CHAPTER 3

New Air Force Logistics System

In this chapter, we describe what the Air Force needs from a recoverable spares requirements, allocation, and distribution system or what the Air Force logistics system should be. We begin by discussing some inventory principles that are academically proven and time-tested applications for inventory management. We then outline the Air Force's goal for a logistics system and the needs that the logistics system must meet. Finally, we propose some actions the Air Force should take to meet its needs.

INVENTORY PRINCIPLES

Some principles of inventory management have been tested and proven over time, and although these principles seem straightforward, inventory managers and logisticians responsible for developing and improving inventory systems tend to lose focus occasionally. So, reiterating these principles is valuable.

All other things being equal, multi-echelon, system optimization models will outperform nonoptimization, single-echelon, single-item models, especially if the system's measure of merit is the optimization goal. [9,10] So, for example, a multi-echelon, multi-indenture model that maximizes aircraft availability at minimum inventory cost will always outperform a single-echelon, single-item inventory requirements model. By outperform, we mean to provide a higher aircraft availability at equal cost or provide equal aircraft availability at less cost. For a group of F-16 items, RAND compared the aircraft availability achieved with three different multi-echelon, optimization models and the nonoptimal SBSS fixed safety level requirements model. Using the same inventory investment for all models, RAND showed that the multi-echelon, optimization models produced a 10 percent higher aircraft availability. [11]

Besides determining inventory requirements based on the correct objective function, these optimization models consider the entire system, both base depot level and end item and their reparable subcomponents. System wide visibility can improve inventory performance. System optimization models outperform single-echelon, single item models. However, even if the requirements model is not system wide, visibility of all assets and inventory performance in the system can improve performance. For example, an item might not have sufficient assets at the depot but have extra assets available at base level. The depot might needlessly procure more assets because personnel are unaware of the base asset.

This system visibility example points out that, when managers see only a piece of the system, system suboptimization is possible. For example, managers

who see only data from their sections might reduce transportation funding and, thereby, increase the pipeline and resulting spares cost. They might reduce consumable parts funding and, thereby, increase repair line stoppages and spares and labor cost, maximize base level repair, and increase Air Force labor costs.

Another inventory principle is that shorter pipelines mean less cost, better responsiveness, and better operational performance. Reducing the time it takes to buy, repair, ship, and handle inventory can reduce inventory investment and operational downtime. Reducing the order and ship time one day reduces the computed Air Force recoverable item requirement by $17.2 million ($11.2 million for buy and $6 million for repair).

Another inventory principle is that the efficiency with which an inventory system determines requirements is the most important indication of how that system performs. [11] Other areas, such as determining how to set priorities for buying, repairing, and distributing assets, are important. But despite how well one operates the system, how quickly assets are repaired, and how well they are distributed, the system will not perform effectively and efficiently unless it incorporates the right mix of assets. RAND showed that, even when using an optimal method to set priorities for repair and distribution of assets, without the right mix of assets, the optimal repair model produces lower aircraft availability than a system that optimizes the mix of assets and repairs on a first-come, first-served basis. [11]

ABC analysis is another time-tested practice. [12] ABC analysis is based on observations that, typically, less than 20 percent of the items drive 80 percent of the cost (or activity) and 5 percent of the items account for the majority of cost. It recommends segregating inventory into three categories: the most costly, important *A* items (5 percent) for which special management is cost effective; the important, relatively moderate cost *B* items (15 percent) for which some special management measures are cost effective; and the less important, relatively inexpensive *C* items (80 percent) that do not require any special management actions. In short, it pays to handle classes of items differently and to control investment in ways that appropriately manage the high cost items.

The next inventory principle comes from forecasting theory. Choosing a forecasting method should depend on the time horizon for the forecast. [12] Generally speaking, inventory managers should use a different model for long-term (two to four years) forecasts than for shorter-term (two to four weeks) forecasts. Today the Air Force uses the same method, a two year moving average, to forecast long-term budget and procurement actions (a two to five year forecast horizon) as it uses to forecast short term repair (14 to 90 days).

Goal of a Requirements System

Meeting peacetime and wartime aircraft availability goals with the minimum amount of inventory and operating expense is the goal of the Air Force logistics system. This goal implies that the Air Force should

- make resource allocation decisions based on the largest gain in aircraft availability,
- minimize inventory investment while still achieving the readiness goal, and
- maximize the use of existing inventory and resources at minimal additional expense to increase aircraft availability.

To meet this goal, the Air Force must first develop credible requirements that relate to mission performance (aircraft availability). The budget levels must be dependable and credible; the Air Force must identify the mission impact of any funding changes to its requirement. The system must be responsive to the users, the operating MAJCOMs, in both peacetime and wartime. Aircraft availability should drive buying, repairing, and distribution decisions, and the users must define the aircraft availability goals that dictate the priority of execution decisions (i.e., procurement, repair, and distribution). All subsystems must optimize aircraft availability, the system performance measure, so their performance measures must be directly linked to weapon system availability.

The Air Force should identify and implement improved business practices. If implementation of these improved business practices incurs a major effort or expense, the Air Force should apply the improved business practices to the items that matter the most. For example, if it is not practical or economically feasible to improve a process for all items, the Air Force should use ABC analysis and improve the process for the top 5 percent of the items.

Finally, the Air Force is reducing depot manpower; therefore, the system must be less manpower intensive. The Air Force needs a simpler, more timely requirements system that requires less data or has a much improved database management system.

Current Proposals for Improving the Air Force Requirements System

In an effort to simplify the Air Force requirements system, some have proposed replacing the AAM with a single-echelon model, either a pipeline or an economic order quantity (EOQ). In fact, the AFMC RR team is developing an RDM for prototype testing early in 1996. Efforts are underway to compare the RDM to the AAM. We understand the need to simplify the existing D041. However, we make a distinction between the labor intensive, unresponsive D041 database and its computational engine, the AAM. Conceptually, inventory theory and commercial practice strongly suggest that the single echelon, nonoptimization RDM will not satisfy the Air Force requirements system needs. [13] Even though the RDM is less data intensive, it is not driven by aircraft availability and will result in a higher inventory cost to achieve the same level of aircraft availability as the AAM. The AAM computes the mix of spares that is least costly but still achieves the aircraft availability target. The procurement requirement (mix

of spares) is of paramount importance in maximizing inventory system performance.

We next examine the differences in the data needs for the different requirements models. Table 3-1 lists the types of data needed by a single-echelon, pipeline model (a model similar to the repair cycle demand level computed at the base and RDM); an EOQ model (a model currently used for consumable parts at both the base and the depot); and the AAM.

Table 3-1.
A Comparison of Data Needs for Three Requirements Models

Data needed	Models		
	RDM (pipeline)	EOQ	AAM
Pipeline times	X	X	X
Cost			
Unit	X	X	X
Variable cost		X	
Failure	X	X	X
Program	P	P	X
Asset	X	X	X
Indenture			X
Performance goals	Fill rate	Variable cost	Aircraft availability

Note: P means partially used (used for some items).

All three models have similar data needs. All must have pipeline and failure data to compute requirements. The RDM and EOQ models do not usually use such program data as fleetwide flying hours; however, for major mission changes, these models should use program data to forecast future requirements. Single echelon models, such as RDM, may assume some other model will compute base requirements and ignore base-level failures. However, if RDM does not compute base-level requirements, some other model, perhaps at the MAJCOM level, will need the base failure data to compute requirements. All requirements models will require unit cost and existing asset data to determine and budget buy requirements. Therefore, the only difference is indenture data, which the AAM uses. Visibility of indenture levels results in better, lower cost requirements, but if those data are not available or not accurate, the AAM still computes a more cost-effective requirement than the other two models. This conclusion is based on the assumption that, without indenture data, the AAM will consider all items as line replaceable units.

We think it unwise to replace the AAM with a model that actually requires as much data and more inventory to achieve the same performance. Rather, we

suggest that the Air force make more effort to improve the database that feeds the current AAM computation.

Reducing inventory requires even more data and certainly a more accurate and timely database than exists today. Total asset visibility (TAV), as in the DoD TAV system currently under development, could provide dramatically improved performance with leaner inventories. Under LL, the Air Force is building prototype systems that collect data that are at least in part collected in the current system. But the current system is neither timely nor accurate. For example, reparable/serviceable item pipeline data (RIPDAT) collects pipeline performance data from failure at the base to the return of a serviceable asset to the base's stock level. The current system also collects pipeline data; base repair cycle and order and ship time data are collected in SBSS and D035, and retrograde times and depot repair cycle times are collected in D035. These systems collect the data to feed the Air Force Recoverable Consumption Item Requirements System (D041), but the pipeline data in today's system are fragmented and often inaccurate. In fact, the requirements system uses standard pipeline times more often than it uses the actual times collected by the system. So the Air Force is building a data system to do what the current system is supposed to do but does not do well.

Building a new database is fine, but expending resources to collect the same data twice is potentially wasteful. The Air Force should document the functional need for data, identify the source, and expend resources on the one system that will collect those data. Development dollars used to build prototype systems that may have no long-range use might be better spent improving the current system. Regardless, the Air Force needs to improve its requirements data collection and database systems, and it should develop an end-use architecture for its data system. The Air Force must differentiate requirements computation from the database system that feeds it. The computational model does not make D041 unresponsive and workload intensive; the database, the hardware, and the batch processing environment do.

Proposals to Improve the Air Force Requirements System

To meet aircraft availability goals with the minimum amount of inventory and operating expense, the Air Force should take the following actions.

- *Continue to reduce response times and reflect those reduced times in the requirements system.* The current efforts to reduce base and depot pipelines have demonstrated that pipelines can be reduced. Reducing pipeline times for items in a buy requirement or with a high cost for repair should receive priority attention. However, streamlining the process is only half the battle; the Air Force must also change the factors used to compute the requirements. Changing only the requirements will reduce buy amounts and decrease inventories. In addition, decreasing requirements for items already

in an asset-rich condition will have little impact except to increase excesses. Analysis to determine how, and for what items, to change the requirements system to reflect the achievable streamlined pipelines is needed.

- *Continue to monitor and improve pipeline performance.* The LL demonstrations to date have shown significant improvement in pipeline performance. [14] The Air Force has developed special tools to monitor the retrograde and performance, but the data systems degrade unless they are actively used for management decisions. An Air Force Logistics Management Agency (AFLMA) study documents the improvement in retrograde and resupply time but shows even these reduced times have yet to reach the LL goals. [14] The Air Force must continue improving the systems that code, report, and monitor the performance of LL items. These systems must become an official part of the requirements system. Finally, the Air Force must analyze the pipeline, especially the base portion of the pipeline, and identify and complement the wholesale logistics process improvements.

- *Repair, buy, and distribute according to aircraft availability goals.* The Air Force recently directed the implementation of RBL to set both depot and base levels. The RBL allocates the AAM-computed, worldwide requirement to minimize base-level backorders. The Air Force still must develop, agree on, and implement a repair execution system. EXPRESS appears to meet the Air Force requirement to repair and distribute based on aircraft availability goals.

- *Continuously improve the database and requirements process.* The Air Force must improve the accuracy, validity, and responsiveness of the requirements system database. We propose that AFMC form a team of people who use the database today to define the requirements of the future database. The team should include item managers; production managers; ALC and Headquarters (HQ) AFMC requirements and budget analysts; retail AFLMA, MAJCOM, and Standard Systems Group experts; and analysts familiar with the models that the database feeds. Designing the improved database should be part of the current AFMC effort to review the entire database architecture for AFMC. This effort includes more than just the requirements system from a RR team. AFMC's Senior-Level Management Course has formed a Dirty Data Tiger Team to improve the accuracy of the requirements system database. These teams include both retail and wholesale experts. Besides cleaning up the databases, the teams must put tools in place with which they can continuously monitor the database and take corrective action when inaccuracies are found. For example, if base personnel identify an error in their data in the depot database, they should be able to correct the error immediately, and automatically, rather than at the next quarterly report. In addition to the recommendation to improve the database, we recommend that the Air Force establish a centralized RR team at HQ Air Force Material Command for Logistics that will continuously monitor the requirements models and their databases. We propose a team of math modelers and functional database experts similar to those on the HQ AFMC RIPDAT team or the OO-ALC team that operates DRIVE). The team

will monitor model policy input parameters and data, and make policy exceptions as necessary for individual items or circumstances. The team should include at least one MAJCOM liaison officer. The team's responsibilities will include but not be limited to the following:

- Ensuring that the aircraft availability targets are properly loaded in the requirements models.
- Monitoring wartime direct support objectives (DSOs) and resupply factors.
- Correcting data errors identified through screening rules that effect RBL allocations.
- Modifying DRIVE scenario data to reflect mission changes.

- *Ensure that the depot-level reparable system motivates base and depot performance toward the same logistics goal.* The Air Force must continue efforts to reduce depot level-reparable (DLR) operating expenses and ensure that the financial accounting system accurately reflects depot repair costs. Currently, the cost to base operations and maintenance funds of the depot that is repairing an asset does not accurately reflect the true marginal cost of the repair. The bases, therefore, are motivated to repair items and avoid DLR charges. This practice may not be cost-beneficial to the Air Force. [15]

- *Reduce inventory for other, non-demand based major requirements categories.* Currently, a significant number (over $3.9 billion of additive, special levels, floating stock, and insurance item requirements) of Air Force gross spares requirements are not computed in D041. [16] If the Air Force wants to reduce inventory significantly, it must find ways to reduce these non-demand based requirements. This effort includes exploring ways to reduce wartime nonoptimized (NOP) item requirements through improved forecasting, marginal analysis, regionalization, or consolidation. Similarly, the Air Force should find ways to consolidate and reduce additions to spares support lists (both initial and follow-on provisioning) and base adjusted levels.

- *Analysis of the readiness spares package (RSP) requirements.* The Air Force has made considerable changes to its wartime RSP requirements in the last five years, but the Air Force's contingency taskings are changing even faster. Air Force requirements policy must keep pace. The Air Force must analyze and determine the resupply time, the support period, and the direct support objective for its future RSPs.

- *Develop a credible OWRM requirement.* The OWRM concept that some spares over and above POS and RSP requirements are necessary to sustain a wartime operations tempo (OPTEMPO) is still valid. The OWRM requirement should consist primarily of component parts necessary to repair spares at the depot that fail at the bases in the first 30 days of the war, and will be subsequently needed, plus additional spares to replenish condemnations

caused by the increased wartime OPTEMPO. The implementation of the OWRM requirement is more important with the two-level maintenance and LL concepts because the depot is even more important to wartime support. An LMI analysis showed both technical and conceptual problems with the current Air Force OWRM computation. [17] However the Air Force OWRM requirement, although unfunded for years and not officially accepted, continues to be reflected in the D041 computation and Air Force Central Secondary Item Stratification (CSIS).

- *Develop lean retention policies.* As part of the analysis to determine how (and on what items) to reduce requirements, the Air Force must analyze its inventory stratification and retention policies and the implications of reducing the requirements with these policies. For many items, reducing requirements will only increase the number of assets in long supply. Although the Air Force can dispose of some assets that are in long supply and, thereby, reduce inventory, the economic benefits of disposal are small. The real goal is to reduce the requirement so that the Air Force buys and repairs fewer items. Therefore, the Air Force must (1) determine which items will yield the greatest improvement through applying process improvements, (2) determine how and when to reflect those process improvements in the requirement, (3) determine how to reflect the new requirements in the stratification, and (4) determine an appropriate retention and disposal policy.

- *Stock fund motivation.* The Depot Level Reparable Stock Fund is approaching its fifth year. We suggest it is time to revisit stock funding to determine if it has achieved its goals. More specifically, does stock funding support LL and is it consistent with the centralized direction the requirements system is taking? In recent reports, RAND and LMI [20,21] have questioned the costing methodology and suggest that inaccurate pricing motivates ineffective and costly behavior. [18,19] The AFLMA's two-level maintenance analysis indicates that stock funding motivates bases toward more base-level repair, a trend contrary to the goals of two-level maintenance.

CHAPTER 4

Future Air Force Requirements, Allocation, and Distribution Systems

SYSTEMS ARCHITECTURE

The following proposed architecture is a broad outline of the systems composing a recoverable spares logistics system for the Air Force. We divide this chapter into three sections. The first section encourages the Air Force to continue its efforts to streamline the logistics process. The second section outlines the subsystems we propose for the future Air Force logistics system. The third section discusses data needs and database management.

STREAMLINE THE PROCESS

Simplifying and streamlining the business practice being automated before addressing the associated automated systems is a basic principle of an automated systems project. First and foremost, any inventory system will improve when pipelines are reduced. Reducing the pipelines reduces inventory investment, decreases the number and duration of backorders, and generally tends to mitigate even the worst inventory management systems. The current Air Force efforts to reduce base processing in transit and depot repair times are showing great promise and should be continued and even accelerated. If it is not practical to reduce pipelines for all items, the Air Force should select the items with the most potential to reduce repair and buy requirements.

The Air Force should also expend efforts to reduce the procurement process pipeline. These reductions include the time from order identification through administrative lead-time to procurement lead-time. Reducing administrative and procurement lead-time shortens the forecast period and increases forecast accuracy. Increasing forecast accuracy reduces the inventory investment needed to cover forecasted condemnations.

FUTURE AIR FORCE REQUIREMENTS SYSTEM

Consolidation and centralization in an effort to reduce inventory costs is the trend at DoD. The Air Force is consolidating base logistics systems into regional centers, moving base and intermediate repair to the depots, and developing centralized databases to maintain Air Force-wide visibility of inventory. Inventory theory confirms the efficiency of centralized, multi-echelon inventory systems.

Our proposed subsystems rely on centralized systems to compute requirements, allocate levels, set priorities for buy and repair, and distribute assets. Table 4-1 outlines the model and subsystems for our proposed architecture.

Table 4-1.
Proposed Requirements System Architecture

Model/system	Function					
	POS buy rqmt.	Repair rqmt.	Repair execution	Wartime buy rqmt.	Peace-time alloc. and distr.	Wartime alloc. and distr.
AAM (buy)	X					
AAM (near-term execution)		X			X	
RBL					X	
EXPRESS			X		X	X
ASM				X		

Figure 4-1 displays our proposed architecture for computing POS requirements and allocating levels to the bases and the depot.

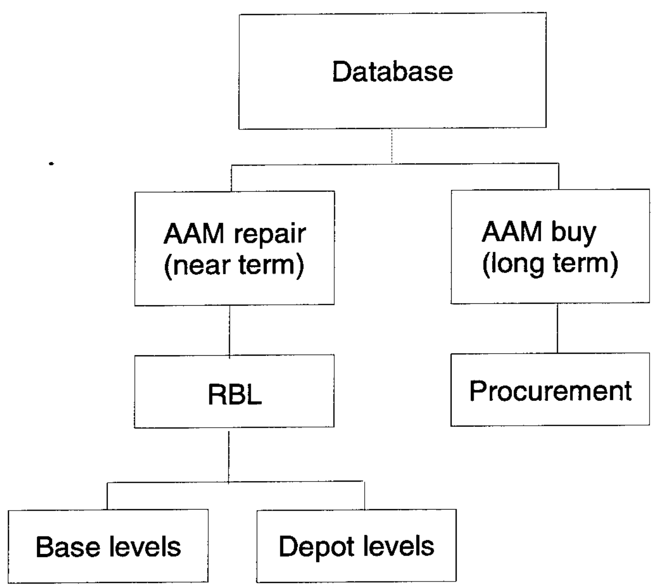
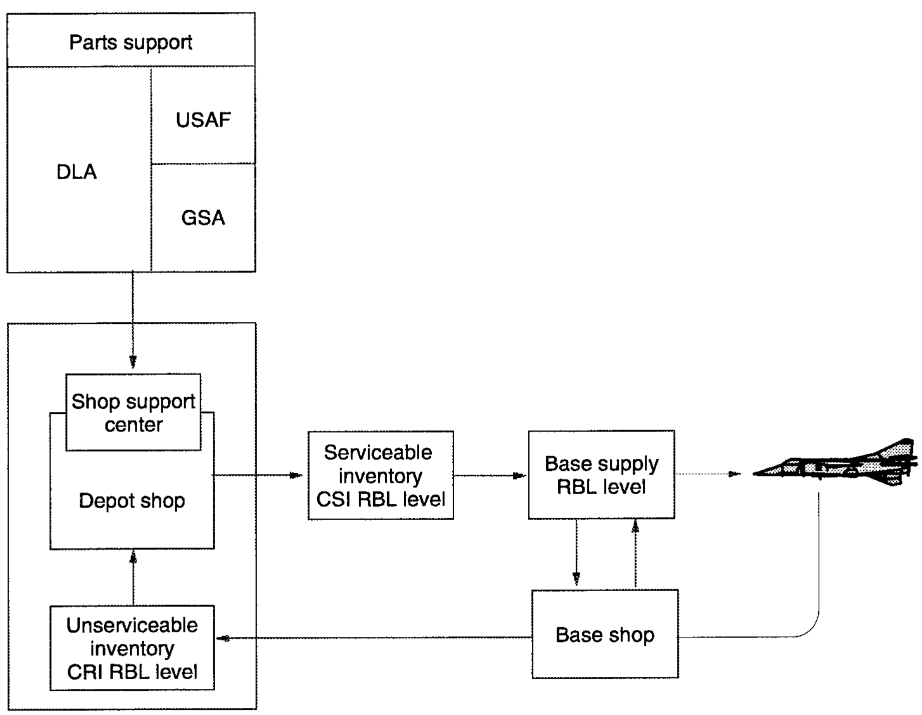


Figure 4-1.
Primary Operating Stock Requirements and Leveling

We propose two versions of the AAM to compute requirements. First, we propose today's AAM to compute buy requirements for both full and partial funding requirements. We also recommend that the Air Force use the AAM's output to trade aircraft availability among competing weapon systems and, therefore, allocate limited buy dollars to individual weapon systems. The buy AAM computes long-range requirements for at least a leadtime plus a budget period in the future.

We propose a second version of the AAM, the basis of which the Air Force already has, to compute near-term execution requirements. This version will use shorter range forecasting methods, more accurate (achieved versus achievable) pipeline times, and repair costs rather than procurement costs to determine the best mix of spares to repair and distribute. This second version of the AAM will provide a more accurate reflection of repair requirements since it will not have to simulate demands over a multiple year period to forecast requirements, and it will use short-range forecasts of OPTEMPO (e.g., flying hours) and pipeline times. The near-term forecast version of the AAM should be the requirement fed to the RBL. The Air Force should also use the repair AAM to make such medium-range capacity allocation decisions as shop capacity, shop manning, and repair budgets.

Figure 4-2 shows the organizational and intermediate maintenance (OIM) reparable logistics pipeline.



Note: USAF = United States Air Force; DLA = Defense Logistics Agency; GSA = General Services Administration; CSI = Consolidated Serviceable Inventory; and CRI = Consolidated Reparable Inventory.

Figure 4-2.
Reparable Logistics Pipeline

Our proposed architecture uses EXPRESS to set priorities for spares for repair and distribution of assets. RBL will determine the levels for the depot — Consolidated Reparable Inventory (CRI) — and the Consolidated Serviceable Inventory (CSI), and the bases. EXPRESS then determines what items to induct and when to induct them from the CRI into the depot repair shop. EXPRESS uses either DRIVE or the working/CSI level repair induction method (induct when the CSI balance falls below the CSI level). Earlier in this report, we expressed concerns about EXPRESS. For example, are DRIVE targets consistent with the wartime requirements aircraft availability targets, and how will the CSI priorities merge with the DRIVE priorities? We still have those concerns. But conceptually EXPRESS is appealing. EXPRESS is *repair on demand* with an aircraft availability flavor. It uses the most current data to set repair priorities for a short (two-week) planning horizon. EXPRESS also is a near-term resource allocation tool that uses operational measures (weapon system availability) to allocate constrained resources. The DRIVE component of EXPRESS considers both peacetime and wartime requirements and sets repair priorities. More work is needed to determine the best way to use DRIVE in an actual wartime setting to distribute levels. Conceptually, the model will react to wartime operations scenario input, but the data feed procedures must be standardized.

Whether to include DRIVE in EXPRESS or use the RBL-derived working and CSI levels to determine when to induct items for depot repair and to set priorities for depot backorders for asset distribution is a controversial topic. When compared to the current system, DRIVE offers four advantages, but the working/CSI level repair induction method has some of the same advantages as DRIVE:

- DRIVE uses current data and a more accurate planning horizon to set priorities for repair. DRIVE's repair requirement is far superior to the MISTR computed requirements. The working CSI level repair on demand technique also has this advantage over MISTR.

- Although there is some question about its objective function, DRIVE is a multi-echelon model that focuses on determining repair priorities. The D041 AAM computes buy requirements and backs into a repair requirement. So again, DRIVE, because it considers resources directly affecting repair (shop and repair funding constraints), has better repair priorities than MISTR. The working/CSI level method sets priorities based on *deepest hole methodology;* with this method, users set priorities for repair and distribute to the level that is the least filled. Aircraft availability and marginal analysis techniques for minimizing backorders will produce different repair inductions and asset distribution than the *deepest hole* methodology. RAND showed that RBL (called Multi-echelon Technique for Recoverable Inventory Control in the RAND study) performance was "more robust when using first come first serve disciplines in repair and allocation." [11] RAND found a 1 or 2 percent difference in aircraft availability when using DRIVE and first come, first served by priority group (essentially the UMMIPS) compared to using RBL with DRIVE to determine repair priorities and asset distribution. Conceptually, DRIVE prioritization will provide increased

operational support at some fixed level of repair resources compared to the working/CSI level *deepest hole* method, but apparently the increase is not significant.

- DRIVE provides a way to differentiate support among units. DRIVE can differentiate support by raising and lowering aircraft availability targets by unit. In theory but not yet in practice, DRIVE increases support to higher priority units without significantly lowering support to lower priority units and, thus, provides better control than the current UMMIPS. Currently, no method differentiates support among units with the working/CSI level method.

- One of the Air Force goals is to develop one level for the base that supports both wartime and peacetime needs. In setting repair priorities and distributing assets, DRIVE integrates peacetime and wartime requirements. Neither the current system nor the working/CSI level method integrates the levels.

Clearly the working/CSI level method provides some but not all of the advantages DRIVE offers, and, of course, DRIVE has an associated cost for systems development, database requirements, and the day-to-day operation and maintenance of the model. The Air Force must measure the cost against the additional advantages to determine whether or not DRIVE is worth the extra cost.

RBL is part of our architecture. The Air Force recently approved RBL to set peacetime levels for both the base and depot. However, the Air Force needs procedures for setting long-term contingency support levels (pre- and post-RSP contingency period). Conceptually, RBL can handle reallocation of levels from deploying sites to deployed sites. Again it is a matter of determining the data feeds and procedures to use with RBL.

We would like to make several additional points while referring to Figure 4-2. First, AFMC must reengineer its depot requirement financial management system. We see no need for pre-approved funding by stock number of repair as is done today. With the repair on demand concept, AFMC will only repair based on a requisition from the customer. With this rule-based repair induction system, approving and funding the repair of each individual item inducted into the repair shop is not necessary. The customer has paid for the repair (assuming the requisition reflects a carcass retrograde from the base), and, therefore, no further funding approval is necessary. This change is a significant improvement over MISTR, which requires pre-approved funding on individual stock numbers. However, this method also assumes that all base requisitions reflect valid requirements. If requisitions overstate demand (for example requisitioning for stock replenishment with an awaiting parts asset in the base repair pipeline — two assets for a single demand), repair on demand can bankrupt the reparable stock fund.

Second, requisition accuracy and validity take on an additional significance with the working/CSI level repair induction method. Requisitions will constrain DRIVE distributions and may be used to trigger inductions. Therefore, it is important that there is no delay in receiving requisitions since they may initiate the repair pipeline, and that all requisitions reflect a valid need. There are indications that neither of these conditions are met today. [18] An AFLMA study shows 20 percent of requisitions at base level are not included in the depot database. Conversely, AFMC item managers complain because the base requisition cancellation rate approaches 30 percent. AFLMA has several studies underway exploring these issues.

As Figure 4-2 highlights, RBL will allocate the entire worldwide OIM requirement to the bases and the depot. The Air Force must have an effective way to redistribute assets to locations where they are needed. But, the current reparable redistribution system is ineffective. [21] Item managers are reluctant to redistribute items since, in their view, the base does not honor redistribution orders (RDOs). The AFLMA report shows that only 19 percent of the reparable item RDOs are indeed successful.

The Air Force must have an effective redistribution system, but it will be even more important when the Air Force implements RBL. First, RBL allocates the entire OIM worldwide requirement. The OIM requirement is the number of spares needed to support items that fail at the bases. At least conceptually, RBL allocates all available assets (AFMC repairs and buys so that assets equal the requirement). If some assets are distributed incorrectly and cannot be redistributed, the depot will always have requisitions (or a CSI level) it cannot fill. For example, consider an item with a worldwide requirement of 75. Assume RBL allocates 70 to the bases and the depot pipelines and has a CSI level of 5. If 10 assets are distributed incorrectly (assets exist above the requirement for that location), the CSI will seldom, if ever, have a positive balance; the Air Force does not have sufficient assets to satisfy all the levels.

Second, implementation of RBL will initially generate incorrectly distributed assets. RBL is a major change to the base levels, and the Air Force will have to redistribute assets to match the levels. An effective RDO system will be of great benefit for the initial push of RBL levels and also useful quarterly as new RBL levels are pushed.

The system must be fixed and the AFLMA's report contains many recommended solutions. However, the AFLMA report only solves part of the problem. The Air Force should also explore procedures and policies to reallocate assets to match major changes in base levels. For example, for major mission changes or deployments, base levels will change. Currently, it will take time to reallocate the assets to match the new levels, since DRIVE will only allocate levels from depot stocks. The analysis effort would analyze data using DRIVE (or some other method) to move assets from one base to another to achieve higher levels of weapon system availability.

Several efforts are underway to improve *retail* supply support to depot maintenance. At the LL users group in 1995, HQ AFMC stated that five separate efforts (one at each ALC) were underway. In addition, HQ AFMC assigned Warner-Robins ALC to conduct a reengineering analysis of the depot supply support process. Improvements are necessary in this important area so that LL can reduce pipelines.

The final part of the requirements system architecture is the ASM in REALM for computing wartime requirements. Originally, REALM was supposed to compute limited funding RSP requirements and wartime availability curves with which system program directors (weapon system level) and item managers (stock number level) could set priorities for allocating scarce procurement funds. However, with stock funding of DLRs and the "spare is a spare" policy, which blurred the distinction between peacetime and wartime spares, the need for a limited wartime spares computation may no longer be a top priority. Rather, the POS buy requirements may assume the limited funding because all on-hand assets would first be applied to the RSP requirement. Then the Air Force can use banding and other limited funding tools to determine the limited spares buy priority list. We recommend that the Air Force explore the feasibility of applying all funding shortages to the POS requirement since applying assets first to the RSP is operational policy.

The Air Force has proposed a single, combined base level that includes both peacetime and wartime needs. Simplifying the management of base levels and at the same time, reducing the amount of inventory by consolidating wartime and peacetime safety levels is the goal. We suggest that the Air Force explore the use of the ASM for computing an integrated peacetime and wartime requirement. This task is not straightforward. Currently, the Air Force uses a systems perspective to compute an average base and multiplies by the number of using bases to determine the worldwide POS requirement and computes peacetime requirements from the top down; wartime requirements are bottom-up; the individual base perspective is summed over all bases. The ASM is a multi-echelon model that will compute requirements over a dynamic (peacetime-war-sustain OPTEMPO) scenario. Therefore, ASM is a good candidate for an integrated computation, but many details need to be worked out.

In the near term, before an integrated computation, the Air Force should examine using a *peacetime offset* for deployable warfighting units. Currently, fight-in-place units reduce (offset) their total wartime requirement by the amount of peacetime stock expected to be on hand. Thus, base inventory requirements are reduced as peacetime safety and base repair stocks are available to satisfy both peacetime and wartime requirements. The Air Force can and should apply the same concept to warfighting units assigned to deploy as they currently apply to fight in-place units.

LMI is currently examining the use of the ASM for initial provisioning. The Air Force needs an effective, defensible method for computing initial requirements, preferably a method consistent with the way the Air Force computes sustainment requirements. Computing initial requirements that are excess

as soon as they are no longer at initial levels makes no sense because the normal Air Force requirements system computation uses the same input factors and results in smaller requirements. The Air Force needs to standardize its method of computing demand-based (or engineer estimates of failures) initial requirements. The ASM is a good candidate for initial provisioning, but regardless of the model chosen, the Air Force needs a standard method to compute initial requirements.

Data Needs

Our proposed architecture is especially dependent on a responsive, accurate database. Any requirements system relies on data, but for a centralized system as proposed here, data are even more important. The Air Force is currently developing such systems as RIPDAT and advanced traceability and control (ATAC) to collect data to measure pipeline performance and provide worldwide asset visibility. Systems exist today that collect those data and are supposed to use the data to compute requirements, allocate resources, and redistribute assets. A number of systems feed pipeline data to D041; however, these systems are not effective and do not satisfy the need for pipeline performance data. Yet these systems feed the requirement, and it is vitally important that the requirements use accurate, timely data.

The Air Force must improve the systems that provide data such as the engine that drives its budgeting, buy, and execution system. We are not suggesting that the Air Force abandon its efforts to build additional systems that will do what the current systems should do. Perhaps these new databases should replace the older systems. The point is that it does little good to measure pipeline times and then not include some reflection of those times in the requirements computation. The Air Force needs to decide how to collect the data needed by the requirements system (either in the current system or some new system) and then to feed that data as appropriate to the requirements system.

Finally, the Air Force needs to measure its performance, so it must collect and report the data to decision-makers. The data collected, reported, and used for decisions should be the same data used in the requirements systems (i.e., how the decisions are executed). The requirements system determines performance, so it should have access to the data with which its performance is measured. The performance measures used are also important because different performance measures motivate different behaviors. We have heard numerous performance measures proposed, including aircraft availability, base backorders, depot and base issue effectiveness, pipeline times, and depot response times.

We propose three sets of performance measures — strategic, tactical, and operational. The strategic measures should be the same as the performance objective used in the requirements and leveling system. So aircraft availability and time-weighted base level backorders are strategic level measures. Tactical measures support and predict the strategic measures. Tactical measures include cann and fix rates at the base and CSI fill rates at the depot. Operational measures are

those metrics that determine the requirement and that require item manager action to ensure accurate requirements. Examples include depot repair time and demand and repair rates.

However, strategic level measures only identify a trend, not the cause of the trend. Tactical and operational performance measures identify causes and lead to management decisions. The AFLMA, in conjunction with WR-ALC, will work with depot operational decision-makers (i.e., item managers, shop schedulers, and foremen) to analyze the decisions they make and the information needed to make those decisions. The performance measures should measure the information needed to make those decisions.[1]

[1] Operational performance measures should be very specific and tailored to individual stock numbers and shops (or pipelines). These should not be a single standard for all items.

CHAPTER 5

Areas Requiring Management Attention and Analysis

INTRODUCTION

In this chapter, we list the areas discussed in this report that need management attention. Table 5-1 lists the proposed areas, indicates whether or not an effort is currently underway, and provides the Office of Primary Responsibility (OPR). If the area has not been assigned to an agency, we suggest an OPR. We also list the chapter in this report in which we describe the need. Readers can refer to those chapters for additional details.

Table 5-1.
Proposed Areas Requiring Management Attention

Title	Current status	OPR	Chap-ter
Other war reserve material	Not tasked	LMI; AFMC; SAO	2 & 3
Near term execution requirements	Not tasked	LMI; AFMC; SAO	2, 3 & 4
Limited buy allocation	Not tasked	AFMC; SAO	2 & 4
Performance measurement	Not tasked	AFLMA	2, 3 & 4
Repair induction management	Not tasked	AFLMA	2
Prototype system data system requirements	In work	AFLMA; AFMC	2 & 3
RDM review	In work	Synergy; LMI	2 & 3
Integration of reengineering efforts	In work	AFMC; AFLMA	2
DRIVE and CSI prioritization merge	In work	DRC	2
Analysis of reduced response times in requirements	Not tasked	HQ AF/LGMM; LMI	3
Base reengineering	In work	AFLMA	3
Definition of requirements database needs	Not tasked	HQ AFMC/LGI	3
Database redesign	Not tasked	HQ AFMC/LGI	3
Formation of an Air Force requirements team	Not tasked	HQ AFMC/LGI	3
Non-demand based inventory reduction	In work	AFLMA	3
Readiness spares packages review			
Support period	In work	HQ AF/LGS	3
Direct support objective	In work	HQ AF/LGS	3
Resupply time	In work	HQ AF/LGS	3
Retention policies	Tasked	LMI	3
Stock fund motivation	Not tasked	AFLMA	3
DRIVE			
Goal setting	Tasked	AFLMA	4
Consistency with wartime requirements	Tasked	AFLMA/LMI	4
Wartime procedures and data	Not tasked	AFMC/LOC	4
DRIVE vs. working CSI level systems	Not tasked	AFLMA	4
Level setting for long-term contingency support	Tasked	AFLMA	4
Requisition timeliness and accuracy	Tasked	AFLMA	4
Redistribution system	Tasked	AFLMA	4
Reallocation	Not tasked	HQ AFMC/LGI	4
Bit and piece parts support	Tasked	OC-ALC; WR-ALC	4
Integrated peacetime and wartime computation	Tasked	LMI	4
Peacetime offset	Not tasked	LMI	4
Initial provisioning requirements model	Not tasked	LMI	4

Note: SAO = Studies and Analysis Office; DRC = Dynamics Research Corporation; HQ AF/LGMM = Headquarters Air Force Maintenance Policy Division; HQ AFMC/LGI = Headquarters Air Force Materiel Command/Item Management Division; HQ AF/LGS = Headquarters Air Force/Directorate of Supply; and AFMC/LOC = Air Force Materiel Command/Logistics Operations Center.

Summary of Proposed Areas Requiring Management Attention

- *Other war reserve materiel.* Document the concept for OWRM and define the need for OWRM. Then develop a credible method for computing OWRM that matches the concept for its use. Finally, determine the impact of the new OWRM requirement on Air Force requirements and retention stratification.

- *Near term execution requirements.* Improve the forecasting method and database to budget repair requirements and allocate central levels.

- *Limited buy allocation.* Determine the feasibility of making one limited spares buy priority list that includes RSP requirements and the limited funding POS requirements.

- *Performance measurement.* Determine the performance metrics that are necessary to measure the requirements system performance and then propose a system to collect the necessary data.

- *Repair induction management.* Determine ways to compute, update, and monitor depot repair inductions. The analysis should include ways to determine when management action is necessary because the expected process is out of bounds. Then incorporate these methods into the repair requirements system.

- *Prototype system data system requirements.* The Air Force has several existing and developing systems that collect pipeline data. Determine the functional need for pipeline data and identify the single source for those data.

- *Requirements determination model review.* Determine if RDM satisfies the Air Force's need for a spares requirements system.

- *Integration of reengineering efforts.* Once AFMC agrees on an overall architecture for requirements systems, organize teams to implement the new architecture. Appoint one agency with overall coordination of the separate efforts.

- *DRIVE and CSI prioritization merge.* Develop a way to merge *deepest hole* CSI priorities into DRIVE *probability of meeting aircraft availability* priorities.

- *Analysis of reduced response times in requirements.* Determine how, when, and for which items the Air Force include reduced response times in the requirements computation. Determine the impact on worldwide requirements for both the full funded and limited-funded (banding) requirements process.

- *Base reengineering.* Analyze and recommend ways to streamline the base repair cycle process.

- *Definition of requirements database needs.* Define the data (and the source of data) needed to compute worldwide requirements.

- *Database redesign.* Develop a useable, accurate, and responsive database to compute worldwide requirements that will remain useable, accurate, and responsive.

- *Formation of an Air Force requirements team.* Develop a charter and form a team to oversee, operate, and continuously improve the requirements process, database, and computational algorithms.

- *Non-demand based inventory reduction.* Analyze and develop ways to reduce non-demand based requirements. Develop requirements and retention policies for these non-demand based items based on LL principles.

- *Readiness spares packages review.* Analyze and recommend policy for RSP resupply time (when resupply starts and how long it takes to get there), support period, and determination of direct support objectives.

- *Retention policy.* After recomputing demand and demand-based requirements for streamlined processes, improved business practices, and improved computational methods, analyze and recommend improvements to the Air Force retention policy. Reducing demand based organizational and intermediate maintenance requirements (the focus of most of today's efforts) has little effect on reducing inventory. The reduced OIM requirement just restratifies to other requirements (e.g., OWRM) and extended retention categories (i.e., contingency and economic retention levels).

- *Stock fund motivation.* Determine whether or not stock funding depot-level reparables is motivating the right behavior and what, if any, changes should be made to motivate cost- and mission effective behavior.

- *DRIVE.* Analyze the goals used in DRIVE, determine the sensitivity of DRIVE aircraft availability targets, and recommend targets (or an alternative objective function) for Air Force use. Determine whether or not DRIVE is consistent with the Air Force wartime requirements computation and analyze policy implications for DRIVE allocations to wartime versus peacetime support. Develop and implement procedures for DRIVE wartime support.

- *DRIVE vs. working/CSI level systems.* Compare the aircraft availability and expected backorder performance of DRIVE to the working CSI level system for repair inductions and asset distribution.

- *Level setting for long-term contingency support.* Develop a method to compute levels and procedures to implement levels for long-term contingency support (before and after wartime support from the RSP).

- *Requisition timelines and accuracy.* Determine the scope and causes of delayed and invalid requisitions. Recommend ways to improve the timeliness and accuracy of requisitions.

- *Redistribution system.* Implement changes to make the Air Force RDO system effective. Changes are a must to ensure that RBL is effective.

- *Bit and piece parts support.* Streamlining repair pipelines will require effective parts support. Several efforts are underway to improve parts support. These efforts should be coordinated and the best of each implemented at the ALCs.

- *Integrated peacetime and wartime computation.* Develop and analyze methods to compute one level for both peacetime and wartime support for a base. In the interim, explore the use of a POS offset for units tasked to deploy.

- *Initial provisioning requirements model.* Investigate using the ASM to compute initial spares. Develop a standardized method, consistent with the Air Force requirements policy and computation, for computing initial requirements.

References

[1] Lt Col Doug Blazer, *Air Force Requirements, Allocation and Distribution System Consistency*, HQ USAF/LEXX Report, April 1990.

[2] *Evaluation of Demand Prediction Techniques*, Logistics Management Report AF601R1, Craig C. Sherbrooke, 1987.

[3] Craig C. Sherbrooke, *Estimation of the Variance-to-Mean-Ratio for AFLC Recoverable Items*, Potomac, Md.: Sherbrooke and Associates, 1984.

[4] Col Joseph Corcoran, *Execution and Prioritization of Repair Support System*, Briefing presented to the 58th Air Force Supply Executive Board, November 1995.

[5] Maj JoAnn Barbaro, briefing presented to the 58th Air Force Supply Executive Board, November 1995.

[6] "Requirements Determination Module," *Technical Digest*, 30 October 1995.

[7] "58th Air Force Supply Executive Board Minutes," November 1995.

[8] Maj Steve Reynolds et al., *Setting Recoverable Item Stock Levels*, AFLMA Final Report LS9500500, Air Force Logistics Management Agency, Maxwell Air Force Base, Gunter Annex, Ala., December 1995.

[9] Craig C. Sherbrooke, *Optimal Inventory Modeling of Systems*, New York: John Wiley and Sons, Inc., 1992.

[10] Harvey M. Wagner, *Principles of Operations Research*, Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1969.

[11] Louis W. Miller and John B. Abell, *Evaluation of Alternative Approaches to Central Stock Leveling*, Draft Report DRR-936-Air Force, RAND Corporation, December 1994.

[12] Richard J. Tersine, *Principles of Inventory and Materials Management*, Fourth Edition, Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1994.

[13] Delta Air Lines Presentation, Inc., *Delta Air Lines Technical Operations Center*, Atlanta, Ga., October 17, 1995.

[14] Capt Ken Hession et al., *Retrograde Analysis for the WR-ALC Lean Logistics Shop Demonstration,* AFLMA Final Report LS9504500, Air Force Logistics Management Agency, Maxwell Air Force Base, Gunter Annex, Ala., August 1995.

[15] Maj Norman Murray et al., *Assessment of 2LM Cost Estimating Procedures (F-16 Avionics),* AFLMA Report LM9500300, Air Force Logistics Management Agency, Maxwell Air Force Base, Gunter Annex, Ala., January 1996.

[16] Randall King, *Inventory Impacts of Lean Logistics,* LMI briefing presented to Air Force Stockage Advisory Board, 9 February 1995.

[17] LMI Briefing Book AF101LN1, *Analysis of the Air Force Other War Reserve Materiel Requirements Computation,* Michael F. Slay, March 1992.

[18] Frank Camm and H. L. Shulman, *When Internal Transfer Prices and Costs Differ: How Stock Funding Depot Level Reparables Affects Decision Making in the Air Force,* RAND Corporation, Undated.

[19] LMI Report PA303RD2, *On the Use of Transfer Prices within DoD: The Case of Repair and Maintenance of Depot Level Reparables in the Air Force,* William P. Rogerson, March 1995.

[20] Capt Rick Nelson et al., *Analysis of the Supply Requisitioning System and Its Impact on Lean Logistics Implementation, Part I: The MOV Process,* AFLMA Report LS9520200, Air Force Logistics Management Agency, Maxwell Air Force Base, Gunter Annex, Ala., January 1996.

[21] SMSgt Richard G. Alford, *Analysis of the Redistribution Order (ROO) Process,* AFLMA Draft Report LS9434910, Air Force Logistics Management Agency. Maxwell Air Force Base, Gunter Annex, Ala., January 1996.

Glossary

AAM	=	Aircraft Availability Model
AFLC	=	Air Force Logistics Command
AFLMA	=	Air Force Logistics Management Agency
AFMC	=	Air Force Materiel Command
ALC	=	Air Logistics Center
ALS	=	Advanced Logistics system
ASM	=	Aircraft Sustainability Model
ATAC	=	advanced traceability and control
BLSS	=	base level self sufficiency spares
CIP	=	Critical Item Program
CRI	=	Consolidated Reparable Inventory
CSI	=	Consolidated Serviceable Inventory
CSIS	=	Central Secondary Item Stratification
CSIVZ	=	Consolidated Serviceable Inventory Visibility Tool
DLR	=	depot level reparable
D028	=	Central Leveling System
D029	=	War Reserves Requirements System
D035	=	Stock Control and Distribution System
D041	=	Recoverable Consumption Item Requirements System
DoD	=	Department of Defense
DRIVE	=	Distribution and Repair in a Variable Environment
DSO	=	direct support objective

Dyna-METRIC	=	Dynamic Multi-Echelon Technique for Recoverable Item Control
EOQ	=	economic order quantity
EXPRESS	=	Execution and Prioritization of Repair Support System
HQ	=	Headquarters
LL	=	lean logistics
LMI	=	Logistics Management Institute
MAJCOM	=	major command
MISTR	=	Management of Items Subject to Repair
NOP	=	non-optimized
NSN	=	national stock number
O&M	=	operations and maintenance
OC-ALC	=	Oklahoma City Air Logistics Center
OIM	=	organizational and intermediate maintenance
OPR	=	Office of Primary Responsibility
Ops/Log	=	operations and logistics
OPTEMPO	=	operational tempo
O&ST	=	order and ship time
OWRM	=	other war reserve materiel
POS	=	peacetime operating stock
RBL	=	readiness based leveling
RDB	=	Requirements Data Bank
RDM	=	Requirements Determination Model (Navy)
RDO	=	reparable redistribution order
REALM	=	Requirements Execution Availability Logistics Module

RIPDAT	=	Reparable/Serviceable Item Pipeline Data
RR	=	requirements reengineering
RSP	=	readiness spares package
SC&D	=	Stock Control and Distribution
SBSS	=	Standard Base Supply System
SFDLR	=	stock funding depot-level reparable
SLMC	=	Senior Level Management Course
SMBA	=	Supply Management Business Area
SSG	=	Standard Systems Group
TAV	=	total asset visibility
UMMIPS	=	Uniform Materiel Movement and Issue Priority System
VSL	=	variable safety level
WR-ALC	=	Warner-Robins Air Logistics Center
WRSK	=	war readiness spares kit

REPORT DOCUMENTATION PAGE

Form Approved
OPM No.0704-0188

1. AGENCY USE ONLY *(Leave Blank)*	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	Jul 96	Final

4. TITLE AND SUBTITLE

Future Vision for the Air Force Logistics System

5. FUNDING NUMBERS

C DASW01-95-C-0019

PE 0902198D

6. AUTHOR(S)

Doug Blazer

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

Logistics Management Institute
2000 Corporate Ridge
McLean, VA 22102-7805

8. PERFORMING ORGANIZATION REPORT NUMBER

LMI– IR503MR1

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

Logistics Management Institute
2000 Corporate Ridge
McLean, VA 22102-7805

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT

A: Approved for public release; distribution unlimited

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

The Air Force maintains an inventory of over $30 billion in aircraft reparable spare parts and spends between $2 billion and $3 billion a year to buy and repair them. To determine these buy and repair requirements, guide the distribution of these assets around the world, and track demand history and item characteristics, the Air Force has built and operates a complex interconnected set of automated systems. In the 1990s, these systems are undergoing an unprecedented degree of review and change. Are these changes compatible with each other and with senior leadership's vision? In this study, we identify the weaknesses of the current logistics system and propose a new architecture that is consistent with Air Force leadership's vision. In the proposed logistics system architecture, we focus on achieving aircraft availability goals at minimum cost. The proposed architecture uses aircraft availability-driven models to compute buy and repair requirements, allocate resources, distribute assets, and measure system performance. The study concludes by identifying 26 areas where senior management must focus attention. Lastly the study recommends the formation of a requirements team to maintain and operate these models.

14. SUBJECT TERMS

Reparable item management, logistics management, inventory management, logistics modeling, aircraft availability, and inventory requirements modeling.

15. NUMBER OF PAGES

56

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
Unclassified	Unclassified	Unclassified	UL